

Réalité augmentée

Christophe Vestri

1 mars 2021

<https://github.com/vestri/CoursAR>

Objectifs du cours

- Connaitre/approfondir la RA
- Avoir quelques bases théoriques
- Expérimenter quelques méthodes et outils
- Réaliser un projet en RA

<https://github.com/vestri/CoursAR>

- Evaluation:
 - Participation et travail en classe (25% + 25%)
 - Projet (50%)

Plan du cours

- 1 mars : Réalité augmentée intro, Unity/Vuforia/ARFoundation
- 8 mars: Construction application RA Unity StarWars
- 15 mars: Smartphone orientation et Geoloc
- 22 mars: Vision par ordinateur et projet
- 29 mars : Résumé et présentation des Projets

Installation unity3D

<https://unity.com/>

Version 2020.2.6f1

Plans and pricing

We offer a range of plans for all levels of expertise and industries.
All plans are royalty-free.

Individual Teams

Student

Learn the tools and workflows professionals use on the job

Free

[Sign up](#)

Eligibility:
Students enrolled in an accredited educational institution of legal age to consent to the collection and processing of their personal information, e.g., age 13 in the US, 16 in the EU. Must join the GitHub Student Developer Pack to be verified.

- ✓ Latest version of the core Unity development platform
- ✓ Five seats of Unity Teams Advanced
- ✓ Real-time cloud diagnostics

Personal

Start creating with the free version of Unity

Free

[Get started](#) [Learn more](#)

Eligibility:
Revenue or funding less than \$100K in the last 12 months

- ✓ Latest version of the core Unity development platform
- ✓ Resources for getting started and learning Unity

Unity Learn

Master Unity with expert-led live sessions and on-demand learning

[Start learning](#)

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Réalité augmentée

Introduction

Christophe Vestri

Plan Cours1

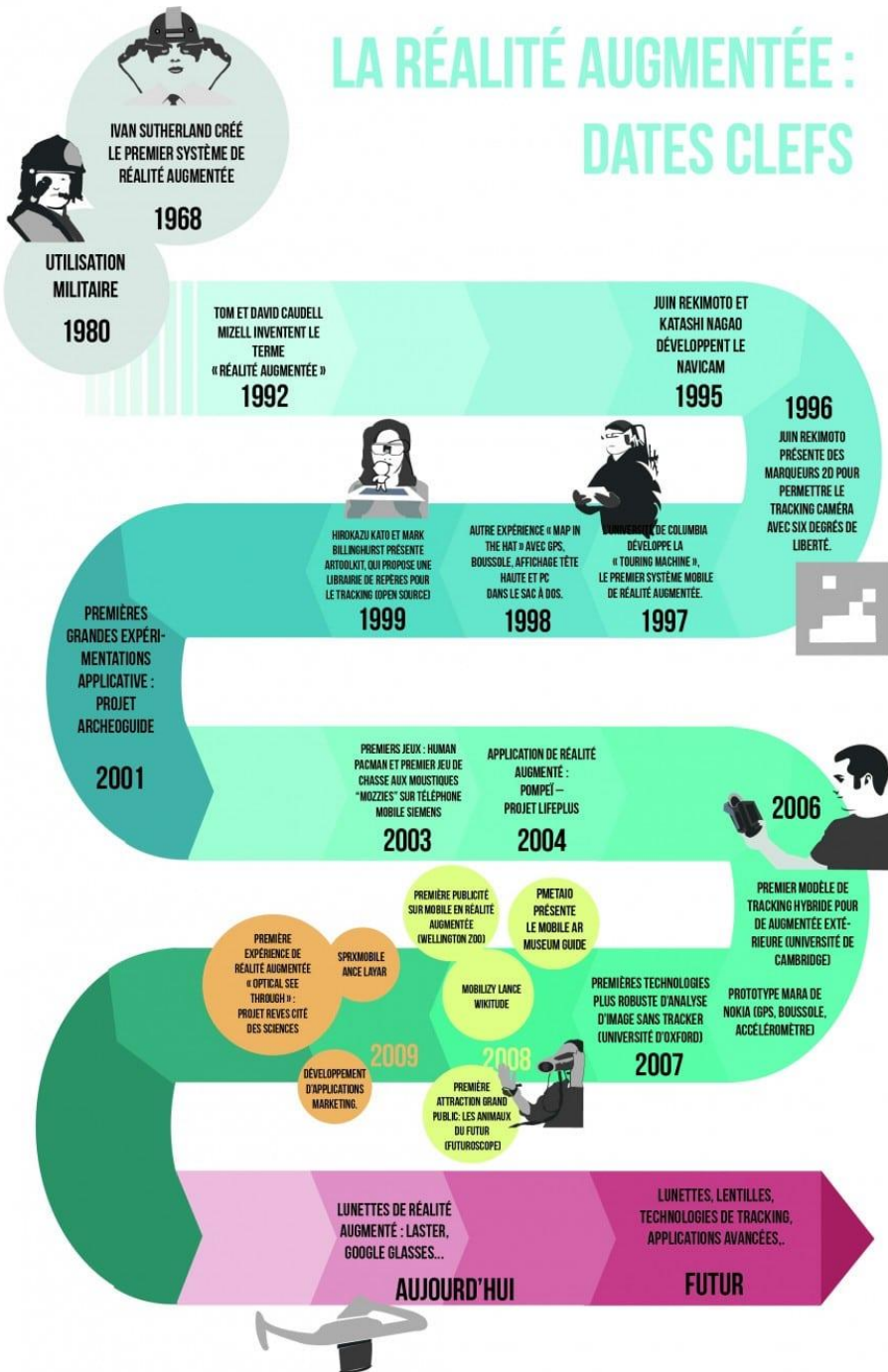
- Définitions Réalité augmentée
- Applications
- Outils
- Démo
- Projet DAM
- Unity3D

Pokemon GO & Genesis



- 5 juillet 2016: lancement
- 2 aout 2016: 100 millions de téléchargements
- 1.6 Millions USD/j au débuts
- Env 1 Milliard USD en 2016 -> 3 milliards
- 2 Milliards en 2020 (malgrès Covid)

LA RÉALITÉ AUGMENTÉE : DATES CLEFS



Rapide historique

Qu'est-ce que la Réalité augmentée?

Qu'est-ce que la Réalité augmentée?

- Augmentée:
 - Amplifier
 - Rehausser
 - Améliorer
- [Wikipédia](#): La **réalité augmentée** désigne les systèmes informatiques qui rendent possible la superposition d'un modèle virtuel 2D ou 3D à la perception que nous avons naturellement de la réalité et ceci en temps réel.
- [RAPro](#) : Combiner le monde réel et des données virtuelles en temps réel

Continuum réalité-virtualité



Environnement
réel



Réalité
augmentée



Réalité
virtuelle



Environnement
virtuel



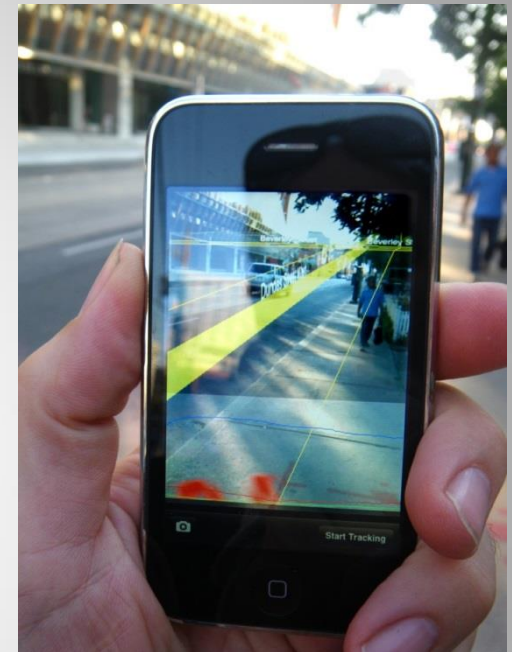
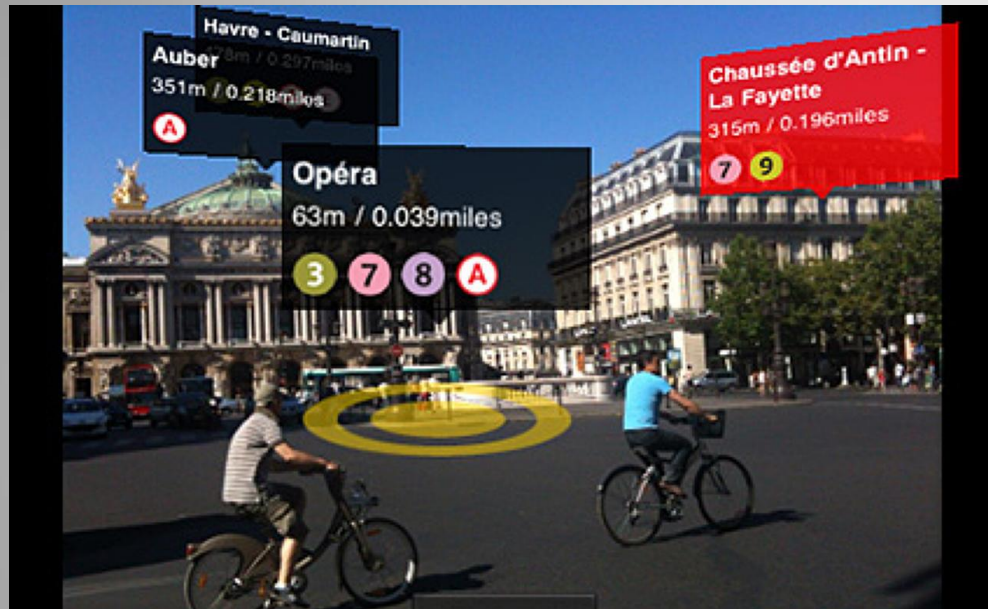
Qqs Demos et vidéos

- <https://ar-js-org.github.io/AR.js-Docs/>
- GoogleTraduction/Wordlens:
www.youtube.com/watch?v=06olHmcJjS0
- Autres videos.... HyperReality
- CES 2018/2019/2020...

Autre définition de la RA

- [RAPro](#) : Combiner le monde réel et des données virtuelles en temps réel
- 5 sens:
 - Visuel: smartphone, lunettes...
 - Sonore: déficients visuels
 - Tactile/haptique: systèmes retour de force
 - Odorat: Cinema 4D
 - Goût:

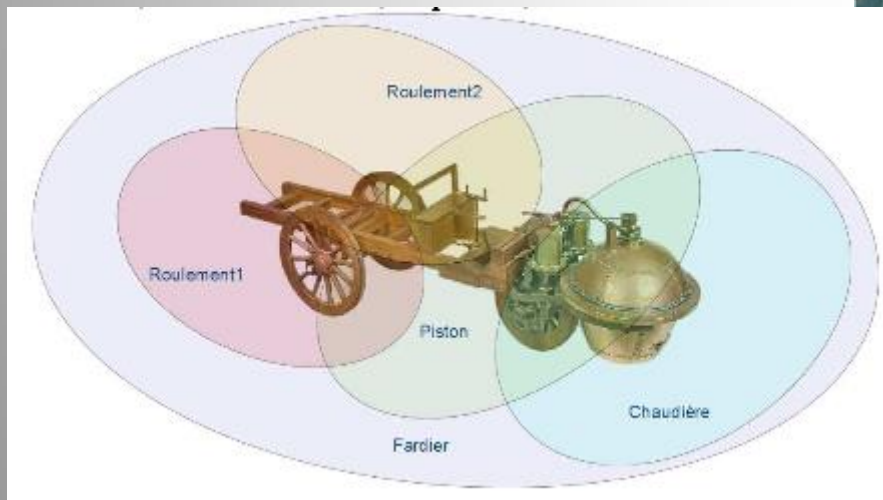
Exemples RA visuel



Exemples RA Sonore



Topophonie



CNAM

Exemples RA Haptique



Sense-Roid



Peau artificielle



Examples RA Olfactive



AMBISCENT



Meta cookies



Vaqso VR

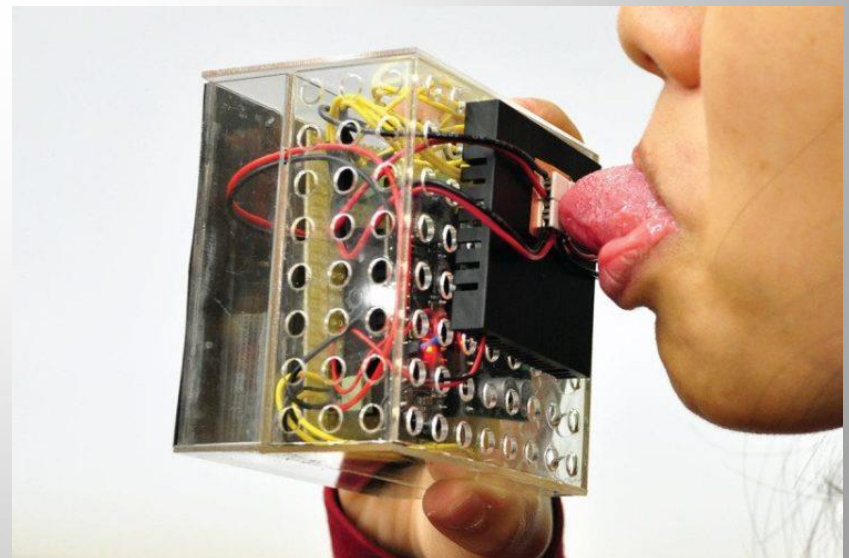
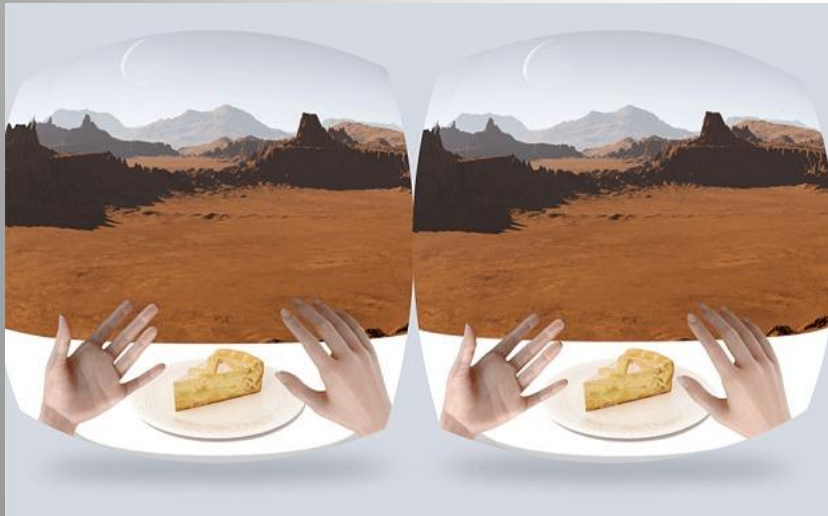


[CamSoda](#) *OhRoma*

Examples RA gustative



TagCandy



UIST Tokyo

Applications

- Augmentation de print



IKEA 2014



Idée3com : Application Brisach Vision



Applications

- Manuels augmentés



Applications

- Urbanisme



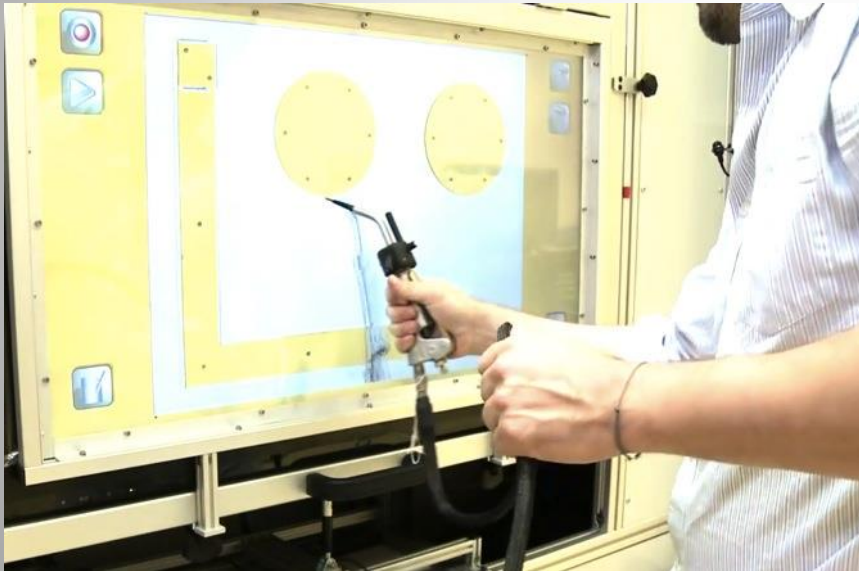
KRAKEN REALTIME



Métropole de Rennes

Applications

- Formation augmentée



CEA list & Renault : gestes techniques collage



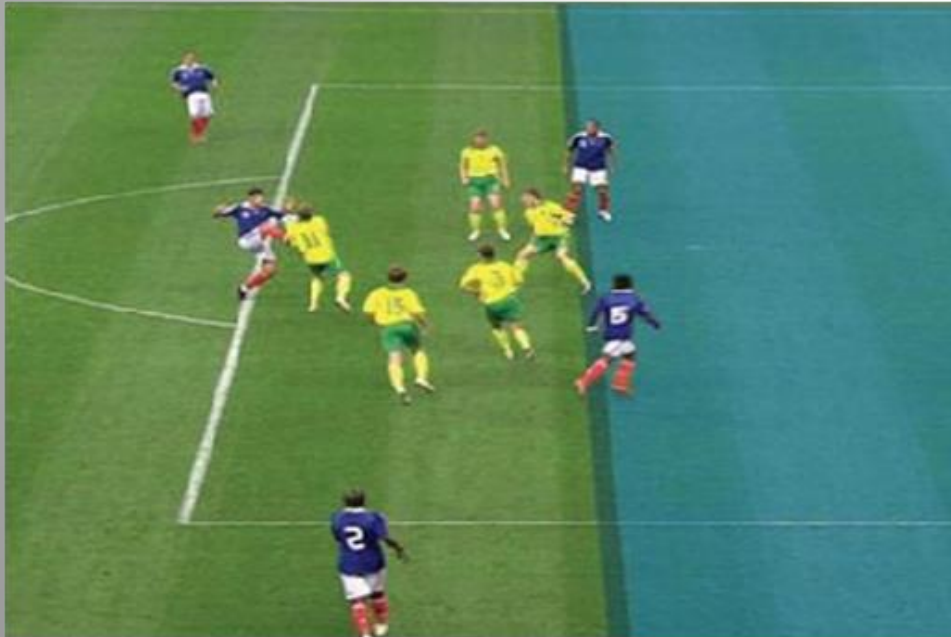
Institut de Soudure



Lincoln Electric

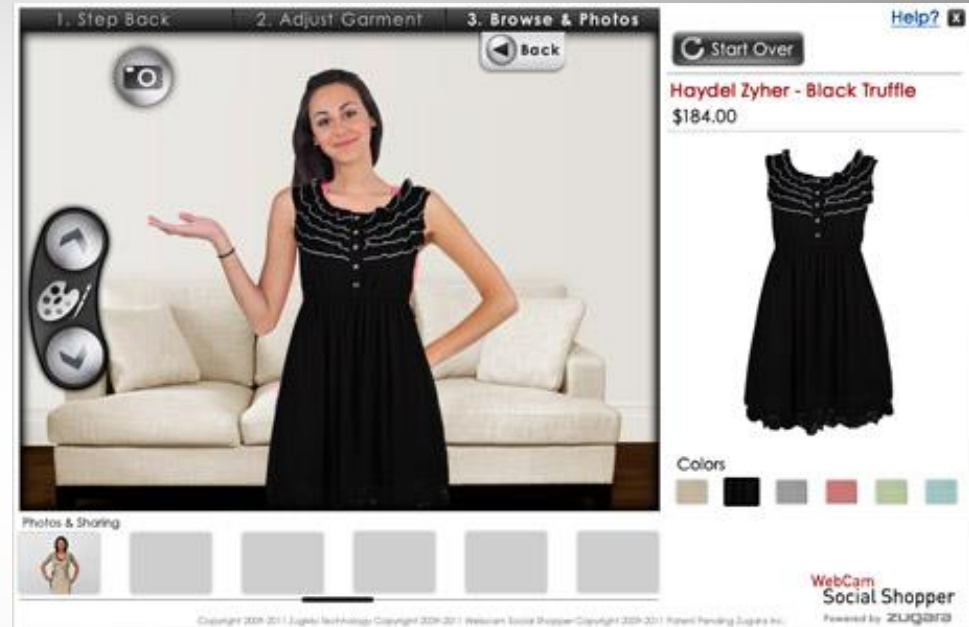
Applications

- TV



Applications

- Essayage sur internet



Applications

- Musées, art, tourisme



Museum d'histoires naturelles de Washington



MOMO urban art on the Williamsburg Art & Design Building in Brooklyn.



Applications

- Médical



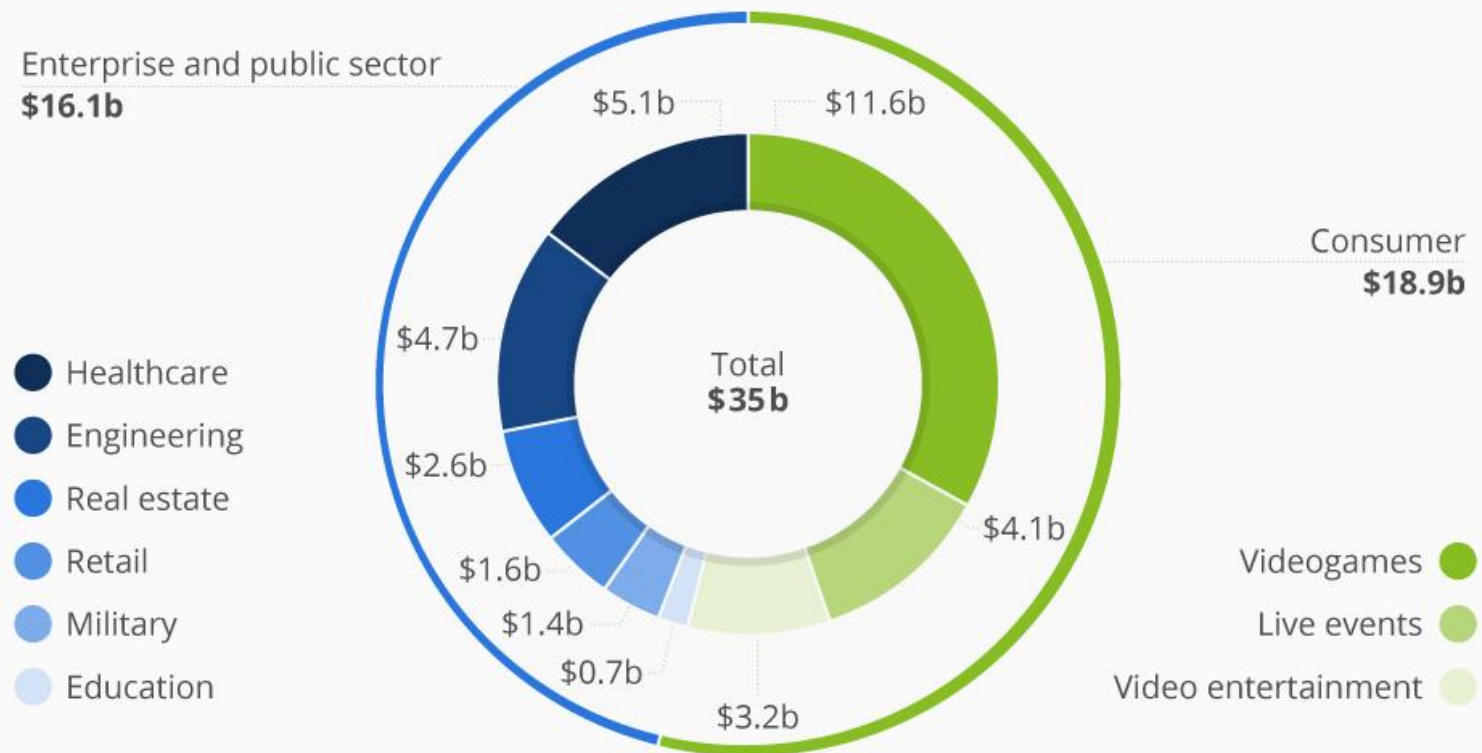
VeinViewer



Future Market

The Diverse Potential of VR & AR Applications

Predicted market size of VR/AR software for different use cases in 2025*



@StatistaCharts

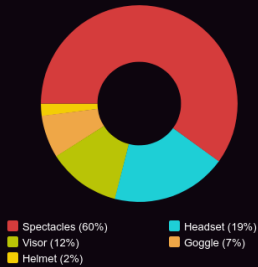
* Base case scenario

Source: Goldman Sachs Global Investment Research

statista

Economie – AR Smart glasses

FORM FACTORS



42

AR smart glasses in market or in advanced stages of development



\$1,000

median cost of AR smart glasses on the market

ANDROID DOMINANT OPERATING SYSTEM



60%

of AR smart glasses are powered by Android



Android (60%)
Microsoft (16%)
Other (24%)

PRIMARY MARKET IS THE ENTERPRISE



60%

of AR smart glasses are intended for commercial or industrial purposes



DHL drove a 25% increase in efficiency using Vuzix M100 smart glasses as part of a picking solution

Boeing cut production time by 25% and reduced error effectively to zero using Google Glass in its wiring harness assembly

Thyssenkrupp Elevator has reduced the average length of service calls by 4X by provisioning HoloLens to 24,000 technicians



THE HOLY GRAIL OF AR: FIELD OF VIEW (FOV)

33°

average AR smart glasses FOV



FOV (degrees)

COMMON USER INTERFACES

GESTURE



48%

VOICE



71%

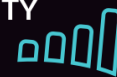
BUTTON



79%

FEATURES TO WATCH

CONNECTIVITY



Only 14% of AR smart glasses support LTE. As 5G networks emerge expect to see more AR smart glasses support cellular connectivity.

DEPTH SENSOR



26% of AR smart glasses are equipped with Depth Sensors. As the market moves towards more immersive experiences expect this sensor to be a common feature on go-forward AR devices.

The Definitive Guide to Augmented Reality Smart Glasses is a living resource that contains up-to-date information on AR smart glasses that are on the market or in late stage development. This interactive infobase aims to help consumers and organizations in selecting the right device for their needs. Visit <http://arglassesguide.com/>

Sources

The Definitive Guide to AR Smart Glasses: <http://arglassesguide.com/>

APR: <https://www.apr.com/landing/landing/>

Vision: <http://www.processeurope.com/news-releases/vision-smart-glasses-will-be-arg/>

Component of the global augmented reality program: <https://www.itsc.com/itsc-2018-01-18.html>

Windows: <https://blogs.windows.com/devices/2018/09/13/microsoft-business-enables-the-possibility-to-transform-the-global-elevator-industry-with-holo-lens-2018-09-13/>

Author: Ron Padzensky

Published in partnership with:

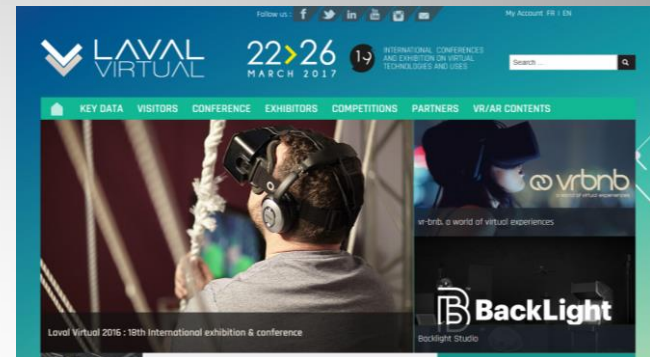
AugmentedReality.org & Super Ventures

Quelques entreprises 06

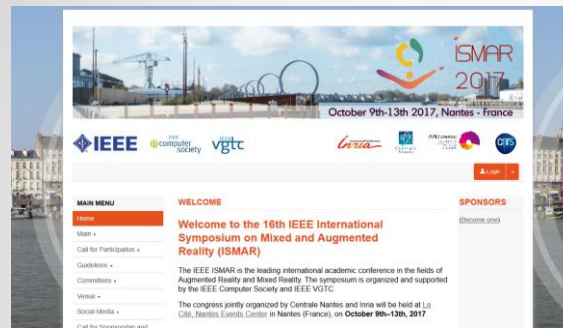
- **Robocortex:** SDK
- **Optis:** Image de synthèse et RV
- **Lm3labs:** interfaces interactives
- **Touchline Interactive:** Dev applis mobiles
- **Tokidev:** Dev applis mobiles
- **Wacan:** Dev applis mobiles
- **Interactive 4D:** Serious Games
- **Avisto:** SSII

Conférences et liens RA

- Laval Virtual



- ISMAR



- RAPro:

- <http://www.augmented-reality.fr/>



- AVFR:

- <http://www.af-rv.fr/>



Autres cours/infos

- Cours <http://web4.ensiie.fr/~bouyer/rvsi.html>
- Cours [Atelier IHM](#) de Nice
- Cours [Master IVI lille](#)
- Coursera: [Getting start with AR](#)
- ARFoundation
<https://www.youtube.com/watch?v=FGh7f-PaGQc>
- Plein d'autres Youtube et tutos technos
- Udemy ([payants](#))

Outils de RA

- Metaio (-> Apple)
- [Unity](#) et [Vuforia](#) (features)
- [Wikitude](#) ([features](#))
- Été 2017: [ARCore](#) et [ArKit](#)
- Autres: [ARToolkit](#), [Sumerian](#), [AR.js](#), [Argon.js](#)
- Liste SDK liste: [**Social Compare-AR-Sdk**](#)
- Lunettes RA: [**Social Compare-AR-lunettes**](#)

Vision par ordinateur et RA

- Camera -> vision par ordinateur
- Plusieurs technologies
 - Détection de marqueurs spécifiques: coins, primitives naturels, carrés, ronds
 - Mise en correspondance: primitives, images
 - Reconnaissance d'image: monument, façade, visage
 - Reconnaissance d'objets: tables, chaise....
 - Recalage caméra: calcule de la pose
 - Traitement d'image: contraste, segmentation
 - Mixer image et synthétique

Pause

Projet final cours AR

- Objectifs:
 - 1 projet chacun avec AR (ou VR) inside
 - Outil que vous voulez: Unity, Vuforia, JS, Arcore, Arkit...
 - Présentation le dernier cours
- Planning
 - Trouver un sujet/idée en RA pour la semaine prochaine
 - Unity/vuforia cette semaine, JavaScript semaine prochaine

Tutoriaux et Idées projets

- Les sites Unity3D, Vuforia et autres sdk
- Chaines Youtubes AR
 - [MatthewHallberg](#)
 - [Edgaras Art](#) et <https://www.ourtechart.com/>
 - Et plein d'autres
- Chaines Unity3D
 - [N3K](#)

Unity et Vuforia

- Préparation du projet Final
 - Installation Unity et Vuforia
 - Test Vuforia ImageTarget
 - [https://library.vuforia.com/](https://library.vuforia.com/gettingstart/Unity) gettingstart/Unity
 - Développement d'une démo Monster/Start wars

Intro Vuforia

- [Vuforia](#)
- Examples [Vuforia In Unity](#)



Model Targets

Model Targets allow you to recognize objects by shape using pre-existing 3D models. Place AR content on a wide variety of items like industrial equipment, vehicles, toys and home appliances.

[Learn More](#)



Image Targets

Image Targets are the easiest way to put AR content on flat objects such as magazine pages, trading cards and photographs.

[Learn More](#)



Multi Targets

Multi Targets are for objects with flat surfaces and multiple sides, or that contain multiple images. Product packaging, posters and murals all make great Multi Targets.

[Learn More](#)



Cylinder Targets

Cylinder Targets enable you to place AR content on objects with cylindrical and conical shapes. Soda cans, bottles and tubes with printed designs are great candidates for Cylinder Targets.

[Learn More](#)



Object Targets

Object Targets are created by scanning an object. They are a good option for toys and other products with rich surface details and a consistent shape.

[Learn More](#)



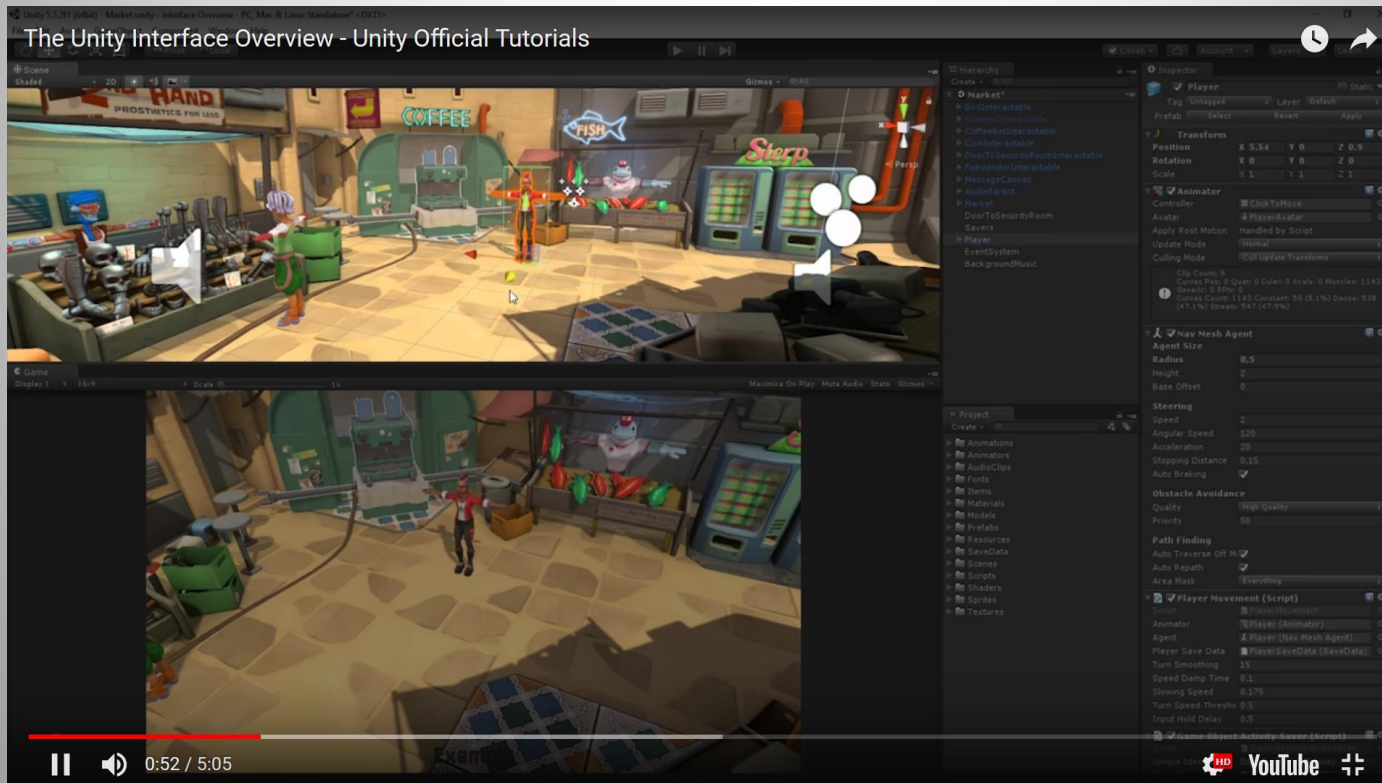
VuMarks

VuMarks allow you to identify and add content to series of objects. They're a great way to add information and content to product lines, inventory and machinery.

[Learn More](#)

Intro Unity3D

- Unity 3D
- AssetStore et Tutoriaux





- Create Unity ID

A screenshot of the Unity ID creation form. At the top is the Unity logo and the text "Create a Unity ID". Below this is a sub-header: "A Unity ID allows you to buy and/or subscribe to Unity products and services, shop in the Asset Store and participate in the Unity community." The form contains several input fields: "Email", "Password" (with an eye icon for toggling visibility), "Username", and "Full Name". Below these is a "Country" dropdown menu with the text "Select country" and a downward arrow. At the bottom, there is a row of icons for different authentication methods: a game controller, a smartphone, a fingerprint scanner, a pair of scissors, and a cloud icon. Above the cloud icon is the text "Click or touch the Cloud".

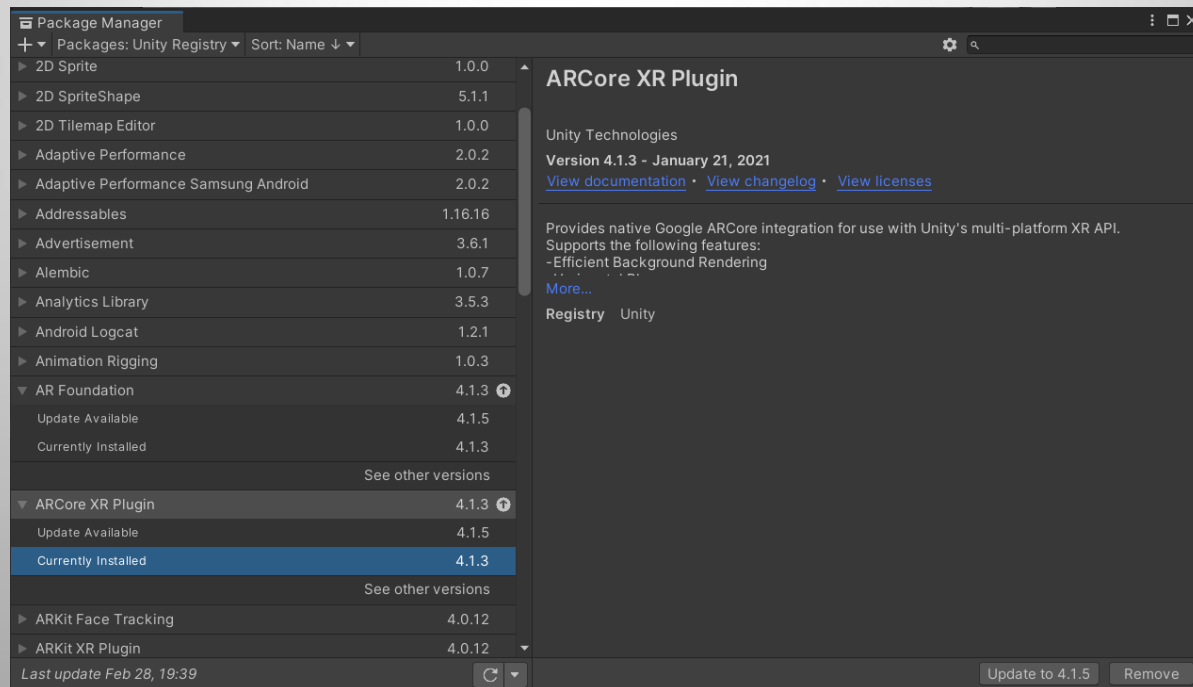
- Create a Project for the demo

Exercice ARFoundation

- Build&settings
- Switch to android
- Player settings
 - Remove vulkan
 - Multithreading rendering on
 - Android version 24 ou 26 mini
- XR plugin -> ARCore
- Smartphone en mode debug

Exercice ARFoundation

- Package manager/ unity registry
 - Ajouter ARFoundation
 - Ajouter ARCore XR plugin ou ARKit XR plugin



Exercice ARFoundation 1

- Création d'une scene AR simple (cube sur surface plane)
 - Supprimer caméra
 - Ajouter AR session et AR Session Origin
 - Ajouter un cube (0.1cm de côté) dans AR Session Origin
- Build settings
- Ajouter la scene
- Brancher votre smartphone
- Build and Run

Exercice ARFoundation 2

- Utilisation ARPlane
 - <https://learn.unity.com/tutorial/configuring-plane-detection-for-ar-foundation>
 - Supprimer caméra
 - Ajouter AR session et AR Session Origin
 - Ajouter un AR default plane, ajouter une Sphere et créer un Prefab
 - Dans AR Session Origin:
 - ajouter AR plane Manager component
 - Drag&Drop le prefab dans PlanePrefab
 - Build & run

Exercice ARFoundation 3

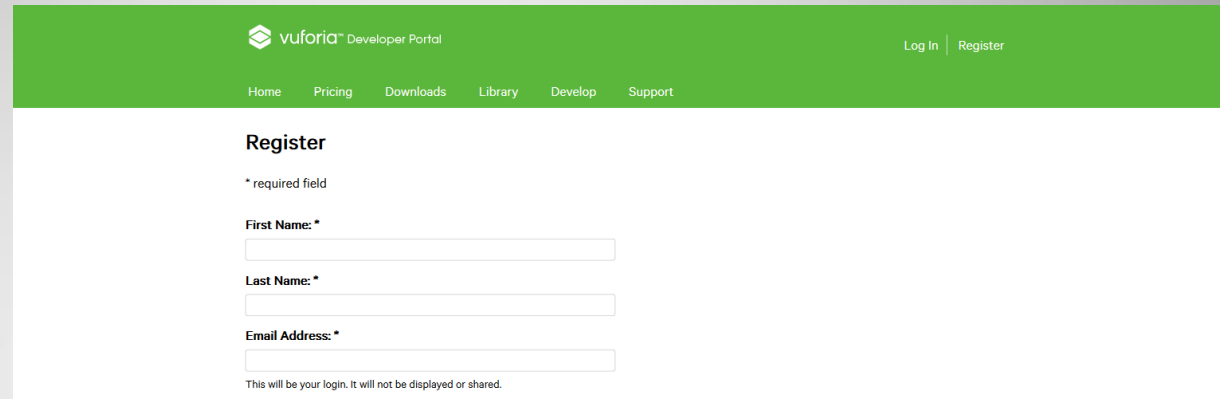
- Utilisation Image Tracking
 - <https://www.youtube.com/watch?v=MdeuA0FITS0>
 - Supprimer caméra
 - Ajouter AR session et AR Session Origin
 - dans AR Session Origin: Add component/AR Tracked Image Manager
 - Dans prefabs: create/XR/ReferencelImageLibrary
 - Dans ReferencelImageLibrary: Ajouter une image .jpg
 - Dans AR Tracked Image Manager:
 - D&D ReferencelImageLibrary et un prefab
 - Ajouter nb detect=2

Exercice ARFoundation Samples

- Dans UnityHub on va charger le projet : Add arfoundation-samples directory
- Build & launch
- Si erreurs de compilation
 - Dans Package Manager: Ajout input systems
 - Dans Build settings/player: allows unsafe mode

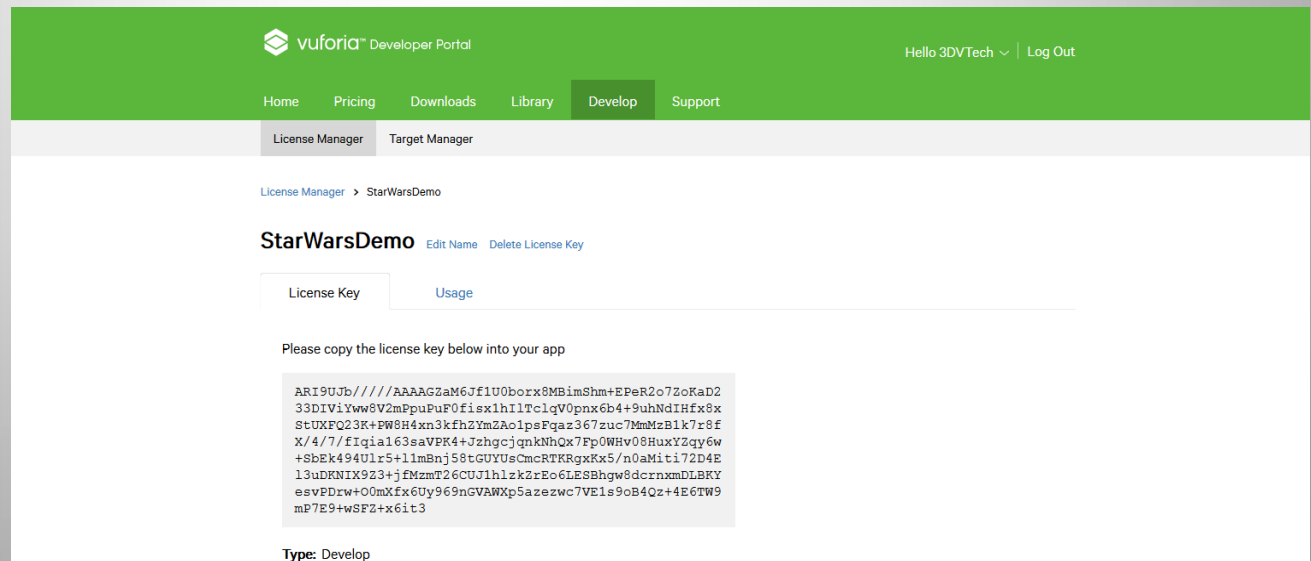
Vuforia

- Register



The screenshot shows the 'Register' page of the Vuforia Developer Portal. The page has a green header with the Vuforia logo and 'Developer Portal' text. Navigation links include Home, Pricing, Downloads, Library, Develop, and Support. The 'Register' page title is centered. Below the title, there is a note: '* required field'. The form contains three input fields: 'First Name: *', 'Last Name: *', and 'Email Address: *'. A note at the bottom states: 'This will be your login. It will not be displayed or shared.'

- Ask for an application license



The screenshot shows the 'License Manager' page for 'StarWarsDemo' in the Vuforia Developer Portal. The page has a green header with the Vuforia logo and 'Developer Portal' text. Navigation links include Home, Pricing, Downloads, Library, Develop, and Support. The 'License Manager' tab is selected. The page title is 'StarWarsDemo'. Below the title, there are links for 'Edit Name' and 'Delete License Key'. The 'License Key' tab is selected. The page displays a long alphanumeric license key. Below the key, there is a note: 'Please copy the license key below into your app'. The 'Type' is listed as 'Develop'.

```
ARI9UJb/////AAAAGZaM6Jf1U0borx8MBimShm+EPeR2o7ZoKaD2
33DIViYw8V2mPpuPuF0fisx1h1ITclqV0pnx6b4+9uhNdIHfx8x
StUXFQ23R+PW8H4xn3kfzYm2Ao1psFqaz367zuc7MmMzB1k7r8f
X/4/7/fIqia163saVPR4+JzhgcjqnKnhQx7Fp0WHv08HuxYZqy6w
+SbEk494U1r5+11mBnj58tGUyUsCmcRTKRgxKx5/n0aMit72D4E
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mP7E9+wSFZ+x6it3
```

Type: Develop

Exercice Vuforia

- Tester Image Target
 - CameraAR (ajouter la license)
 - ImageTarget
 - Ajouter un Objet 3D
- Lancer avec webcam
- Lancer sous android/smartphone

Sample Vuforia

- Sous AssetStore
 - Chercher Vuforia core samples
 - Add to my assets
- Créer un nouveau projet
- Sous Package manager
 - My asset -> installer Vuforia
 - Ajouter license
 - Build & launch

Pour la prochaine fois

- **Commencez à réfléchir idée de projet**
- **Continuez Unity, ARFoundation & Vuforia**
- **Semaine prochaine:**
 - **ARFoundation et Vuforia**
 - **Unity script + Star Wars exo**